Title:
Root Rot studies of fir species in New York Christmas trees production

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Abstract:

The favored tree of NY Christmas tree growers, Fraser fir, often suffers from root rot and sudden death. This work looked at three components of the problem in order to develop solutions for growers. 1) The susceptibility of different varieties of fir: in our field study we found that Turkish fir was the most resistant to root rot. 2) The species of Phytophthora most commonly associated with the decayed root systems: Phytophthora cactorum and P. cryptogea were consistently isolated. 3.) Relationship of soil characteristics with tree death at four NY farms: this data was collected in fall of 2012 and analysis is being concluded in the first quarter of 2013.

Background and Justification:

Christmas tree farming is a multi-million dollar industry in temperate regions of the U.S.; providing fresh-cut trees for decoration and live specimens for transplant. New York State is seventh in the U.S. for Christmas tree producers (844 farms) and total trees harvested (348,043 trees) – an estimated farm gate and consumer retail value of $8.8 and $14.2 million, respectively. Among the Christmas tree species grown, Fraser fir *(Abies fraseri)* has become popular and is now considered a premium tree for consumers and Christmas tree growers in New York State. Unfortunately tree death through a rapid decline has also become common on Fraser fir on many NY tree farms. The areas of greatest tree death appear to be associated with low lying portions of fields and *Phytophthora* infections.

Procedures:
1) Fir Species Evaluation and Phytophthora Identification. In 2011 a field of Fraser firs exhibiting rapid decline was selected for this project. Three alternative species as well as a check row of Fraser fir were planted in the sites where trees had died. Each species of replacement trees was planted among existing trees in 3 replicated rows. The species planted were Concolor fir (*Abies concolor),* Turkish fir (*Abies bornmuelleriana*), Cannan fir (*Abies balsamea var. phanerolepis)* and Fraser fir (*Abies fraseri*) as a control. At the three assessment times in the 2011 growing season all of the 812 trees in the plot were examined for above ground symptoms. This site was monitored in the 2012 growing season as well.

2) In order to understand which species of Phytophthora are involved in the root rot and rapid decline, samples of replacement and existing trees that died during 2011 and

2012were sent to the Hudler lab at Cornell's Plant Pathology and Plant Microbe-Biology Department for Phytophthora species identification.

3) This new part of the project began in the fall of 2012 and looked at soil drainage characteristics to determine if criteria could be established in order to determine if a site is suitable for growing Fraser fir.

Data was collected at four growers' Fraser fir fields in Western NY in November and December of 2012. Measurements were made on water drainage ability in minutes per inch of soil with perk tests. Followed the University of Minnesota protocol for Perk Tests. http://www.extension.umn.edu/distribution/naturalresources/DD0583.html Post hole digger will be surface sterilized prior to moving to each new site. In addition, soil samples were pulled from all sites to be analyzed for water retention, physical properties, nutrient, pH and soil health characteristics. These measurements and samples were collected from both portions of fields where Fraser fir is showing healthy growth and at locations where Fraser firs have died due to root rot. GPS location and elevation measurements were collected for all the sampling sites.

Results and Discussion:

1) Concolor and Turkish firs had significantly higher survival than Fraser fir when used as replants. Canaan fir was not significantly different from Fraser in percent survival.

2) Phytophthora species isolated from symptomatic trees in 2011 and 2012 were *Phytophthora cactorum* and P. *cryptogea*. This is pointing to a conclusion that one or more pathogens such as the *P. cactorum* and *P. cryptogea* are pathogenic to Fraser fir in NY State. This differs from the known pathogen *P. cinnamomi* which is the most common pathogen in the southern growing regions of Fraser fir.

3) The information generated from the soil characteristics is still being analyzed. When completed, if there are consistent markers of problem areas this will be used to as part of a protocol for growers to use to determine which sites on their property are suitable for growing Fraser fir. The results of this soil/site study will be presented to growers at their upcoming grower meetings in 2013.

Keywords:
Pest: root rot,
Setting: nursery, Christmas trees
Management Technique: monitoring, research & education